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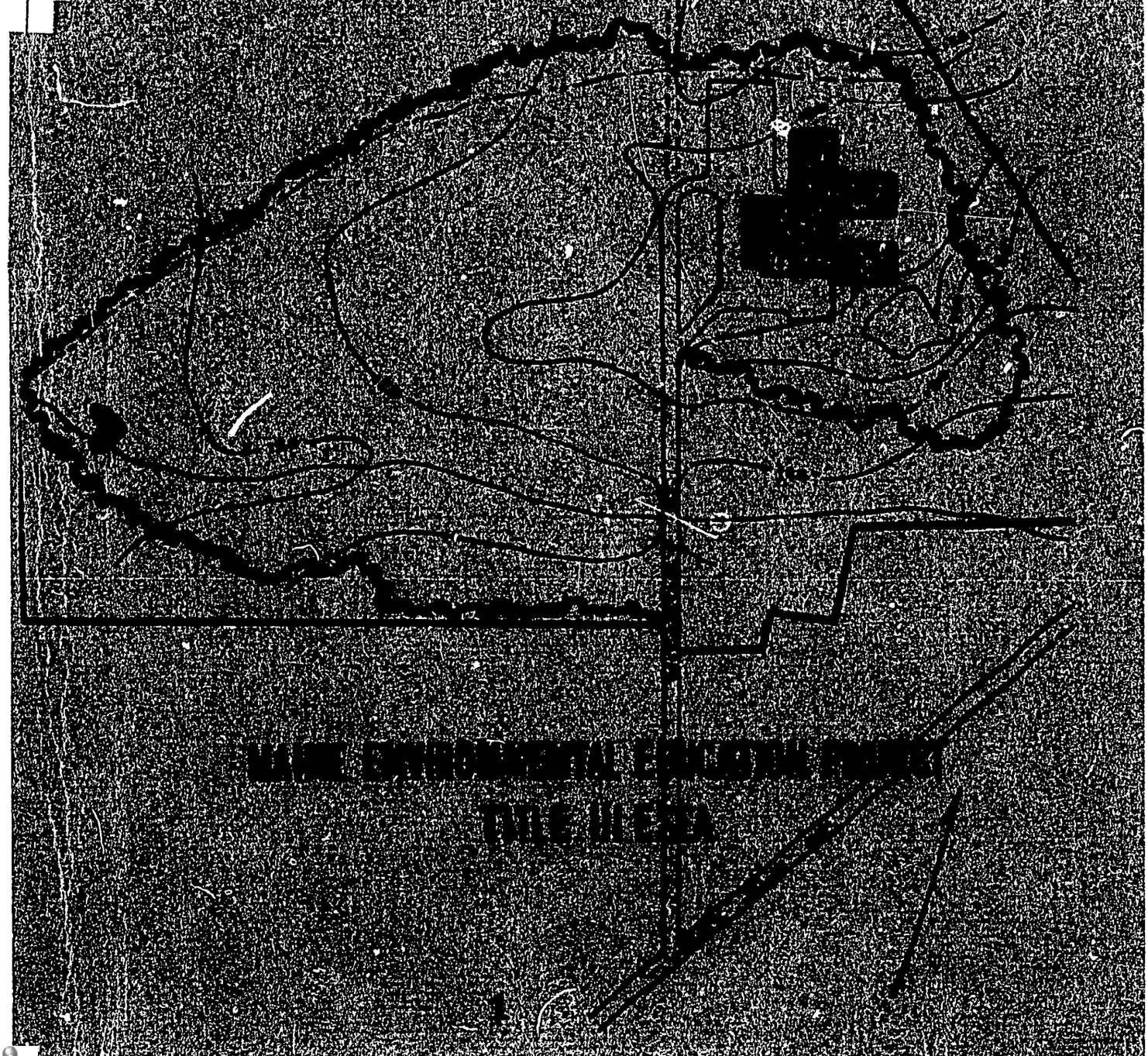
ABSTRACT

Realizing that school sites can play an important role in enhancing the educational process, guidelines dealing with the development of a school site for environmental education purposes are presented. First, the roles of this site for environmental studies are explained as: (1) an ecology laboratory, (2) an environmental management laboratory, (3) a natural history interpretive area, and (4) a multiple-use school and community recreation area. Site planning is viewed as the key to effective school site design, development, and utilization. The three basic phases of planning are discussed in detail. Site Analysis gives an inventory of all factors which may influence the site; natural and man-made influences relating to ecological, economic, political, social, technological, and aesthetic points of view. Program Development is concerned with analyzing the nature of the particular purpose or use for the site. Design Concept Development is the graphic interpretation of how the site and program should be blended into a compatible solution. Accompanying the narrative material are examples of site analysis diagrams; a model of steps in the program development process; and examples of the schematic solution to the design problem. This work was prepared under an ESEA Title III contract. (BL)

the school site in environmental education



THE SCHOOL SITE IN ENVIRONMENTAL EDUCATION

Guidelines for School Site Planning, Development and Utilization in Environmental Education

Prepared by:

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1971

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Maine Environmental Education Project
Title III, ESEA

Yarmouth, Maine

ENVIRONMENTAL EDUCATION AND THE SCHOOL SITE

Introduction -

"Traditionally most schools have given little or no consideration to ways in which the school site can be used to enhance the educational process. For this reason, many of the educational features of school sites are lost during the construction stage. The site is leveled, natural vegetation is stripped from the land, and natural water areas are drained. This approach to school site development results in reduction of the educational potential of the site and the degradation of its aesthetic appeal."[1]

Proper attention to school site selection, planning, and development can help to bring about improvements to the physical facilities and greater benefits to students, teachers, and citizens of the community. The site must be more than just a place to house the physical facilities; it must contribute to the total educational process. In the environmental education program, the site helps to develop understandings, attitudes, and skills by performing several important roles. These roles include serving as:

1. an ecology laboratory
2. an environmental management laboratory
3. a natural history interpretive area
4. a multiple-use school and community recreation area

While considerable overlap occurs between each of these roles, each is sufficiently unique to warrant independent considerations. A brief examination of each role may help to illustrate this point.

Ecology Laboratory -

As an ecology laboratory, the site provides the opportunity for students to observe and study the interrelationships and interactions between the energy, land, air, water, plant and animal components of the natural ecosystem. Such ecological understandings are basic to

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[1] Johnson, Carl, L.A. and Dr. William B. Stapp, et. al. Opportunities for Environmental Education on School Sites. Ann Arbor, Michigan: January 1, 1971.

recognizing and solving problems related to man's use and management of natural resources.

Environmental Management Laboratory -

The site also provides the opportunity for students to work in the area of environmental management. Environmental management seeks to provide solutions to problems through the functions of inventory, planning and design, and development and implementation. Activities involved in each of these functions enable students to work not only with the physical components of the school site environment, but also in the establishment of management policies and controls which influence environmental quality.

Natural History Interpretation Area -

Natural history is a special kind of environmental awareness program. It fulfills both an educational and a recreational function. This is accomplished by combining both historic and scientific fact with skillful interpretation in order to create greater understanding of the natural environment and man's interrelationships with that environment. The on-site tour is but one of many kinds of interpretative experiences employed in natural history interpretation. Each experience, though complete in itself, ideally should attempt to create a desire on the part of the visitor to seek further knowledge about the subject.

Multiple-Use School and Community Recreation Area -

In view of the high costs of today's educational facilities, it is desirable that all possible means be exercised in order to obtain maximum benefits from those facilities. Multiple-use management of school facilities and school sites, particularly oriented toward community recreation, offers a potential which has largely been unexplored The loss of available open space, especially in urban areas lacking policies for acquiring and setting aside open-space reserves, makes this consideration especially important.

It should be apparent that school sites play an important part in the environmental education program. It follows that site planning should deserve considerable attention if maximum educational benefits from school sites are to be realized.

SITE PLANNING

Site planning is the key to effective school site design, development, and utilization. This applies to situations where land is to be selected for new school construction as well as to those situations where facilities already exist. Regardless of the situation, site planning involves three basic phases. These are

I. Site Analysis
II. Program Development
III. Design Concept Development

PHASE I: Site Analysis

Site analysis is an in-depth study of the site's character. It is an inventory of all site factors, elements or components, which may influence, or be influenced by, the development of the site whatever the purpose. The inventory process helps to minimize expenditures and developmental problems during the initial construction period and to maximize physical design capabilities, education, and aesthetic benefits after construction. The inventory data collected and evaluated during this phase is compiled in the form of a schematic plan which is called the "site analysis."

PHASE II: Program Development

A program is a detailed analysis of each of the roles which collectively comprise a particular land use or purpose. Each role, being unique, makes its own demands and needs "felt" on the site. Perhaps a particular role may require certain physical components to be created on the site; perhaps certain site components - water, rocks, or vegetation, for example - should be left; or perhaps certain ones should be removed. Often there are important site amenities on which the activities in a particular role should focus, thus increasing the site's educational value and significance.

Program development and site analysis, therefore, should proceed simultaneously for one influences the other. Forcing an inflexible or predetermined program onto a site may produce less than satisfactory results. Thus, program development reveals site design considerations and implications which help to determine how the site should be altered to fit the purpose and how the roles should be modified to receive full advantage from the site.

PHASE III: Design Concept Development

The third phase of site planning, design concept development, is concerned with developing a solution to the problem in the form of a schematic plan. It combines the site analysis phase and the program development phase into a workable solution which is drawn up in a broad conceptual framework. It is not, at this point, a detailed blueprint.

Upon completion of site planning, professional planners usually organize the components - the site analysis, program development, and design concept, including the rationale for that design, into a "design package." The "package" is presented, together with preliminary cost estimates and alternative design concepts, to the clientele for consideration and subsequent approval of one of the design schemes. Once the decision has been reached to go ahead with a particular scheme, detailed planning is completed, specifications are drawn up, guarantees are submitted and construction begins.

While it is conceded that the functions of site planning, design, and development on the broad scale should be entrusted to professional land planners and developers, our environment, particularly our communities, offer ample evidence that the average citizen needs to have a better understanding of what constitutes good site planning and design. Not only can this provide each citizen with a knowledgeable background for enhancing his own immediate environmental quality at home, it can also help him to appreciate the need for better environmental design in our community development projects such as shopping centers, industrial sites, recreation areas, commercial areas, and housing developments - design which will better fit man's physical, psychological, and social needs and will reflect a greater compatability with the landscape and the natural ecological processes.

In fulfilling its various roles, the school site offers an opportunity for students and teachers to learn and work in the areas of school site planning, development, and implementation in the on-going process of environmental management.

SITE PLANNING

PHASE I: Site Analysis

SITE ANALYSIS
INTRODUCTORY INFORMATION

Securing Base Maps -

Topographic maps and aerial photographs are helpful in giving an over-all broad picture of the regional and community characteristics. U.S. Geological Survey maps are not generally satisfactory for gathering or locating details on an area the size of a school site due to their relatively small scale. It is possible to obtain large scale aerial photographs which do provide some detail on larger sites of, say, fifty or more acres.

A school site plan showing the site, building shapes and other features is often included with the contractor's original set of prints used during the time the school was constructed. Site information may also be obtained from property maps or tax maps at the community office buildings or city hall.

The time invested in securing good base maps is well spent for they can help to provide valuable information such as site boundaries, topography, building shapes and locations, swales and drainages, natural vegetation, and other important features. This kind of information helps to make the final analysis more accurate and prevents wasting time in the field duplicating the efforts of others.

Regional and Community Influences -

The introduction to the analysis should identify and relate the site to the community and regional setting. This information is important for it helps to explain the nature of the site, its physical character and past and present development in terms of the broad regional and community influences which have helped to shape it.

The following information could be included:

Geographic Location - region, state, county, township, etc.

Size - regional, community, and site size in square miles, acres or other appropriate units of measure.

General Information and Statistical Data - to include Natural, Cultural, Historic, Economic, Social, Institutional and Recreational influences which help to define and reveal the character of the site. Examples:

- Natural - regional climatic factors, regional historical geology and soils, resource distribution, and types
- Historic and Cultural - ancient, pioneer, and contemporary cultural influences
- Economic - history of land and resource use and development; industrial/agricultural/commercial development influence, income distribution

ON-SITE CHARACTERISTICS AND INFLUENCES

Topography and Drainage -

Land form and surface movement of water upon the land affect a wide variety of planning considerations and decisions. Circulation linkages and routes of travel can be constructed to take advantage of the shape of the land and thus provide greater comfort and value to the user. Analysis of the site's topography - its ridges and drainage pattern, flat lands, easy grades, and steep slopes - can help in the organization and physical arrangement of the site for development purposes. Consequently, the planner should keep in mind many site characteristics and features which are directly or indirectly related to topography and thus influence various site uses and activities. Among these are: percent of slope, orientation to the sun, wind movement, cold air and frost pockets, temperature, susceptibility to erosion, pedestrian and vehicular circulation and separation, natural entrances and exits, acoustical properties, overall scale of the landscape, vegetation - type, density, and quality - water runoff rate, water quantity and quality, aesthetic views, surface water habitats and system of linkage, aquifers, aquifer-recharge areas, landscape texture, light and shade values and patterns, land use limitations, and other amenities or limitations imposed by topography and drainage.

Ecology of the Site -

During site analysis it is important to identify ecological characteristics of the site. Ecology is the science which studies the interrelationships and interactions between organisms and their environment. In the natural environment, living organisms and nonliving components are constantly interacting upon each other. Exchanges of materials which take place between the living and nonliving parts follow complex circular pathways or cycles. It is important for man to recognize that these interactions are extremely vulnerable to outside disturbance and that wherever or whenever these relationships are destroyed or altered the level of quality of the environment may be decreased.

Generally speaking, the most stable and productive environments are those which have the greatest diversity of organisms, of habitats, and of successional stages. During school site analysis, it is important in assessing environmental quality to make comparisons between the population of any given species and the total number of species present. "High quality" is indicated not by the greatest number of a particular "kind" (of organism, habitat, or successional stage) but by the most "kinds" of:

Plants and Animals - e.g. grasses, shrubs, trees, insects, fish, birds, other wildlife

Habitats - e.g. forest, shrublands, grasslands/fields, dunes, wetlands, etc.

Successional Stages - e.g. primary, secondary, climax stages

Social - population data, age, employment and income

Institutional and Recreational -types, locations, regional/community importance, etc.

In addition, significant or unique ecological factors should be noted during the general site analysis. These might include:

> indicator species of site or micro-site quality, local and micro-climatic conditions, unique or superlative specimens of interest, evidences of natural or man-made environmental influences (ecological problem areas), other important or unique factors related to land, air, water, plant, animal and energy interrelationships on the site.

Obviously, field observations such as these are only rough indicators of site quality. For use as an ecology laboratory, a site should receive much more intensive analysis. Such an analysis would normally be pursued in connection with the program of study and, in fact, would consist of a more-or-less continuous inventory.

Vegetation -

Analysis of vegetation on the school site should not only be considered in relation to its ecological value but also in terms of its architectural, engineering, climatic control and aesthetic values.

Architectural value of vegetation includes its use in defining exterior space by forming walls, canopies and floors, in screening out objectional views, and in privacy control.

Engineering uses of vegetation include siltation and erosion control, acoustical controls, atmospheric controls and glare and reflection reduction. Vegetation can reduce objectionable noise by absorbing, deflecting, or defracting sound; it can help control atmospheric pollution by screening out atmospheric particulates and by absorbing CO_2. Also, in urban areas especially, vegetation is being utilized effectively as barriers against excessive glare and reflection from high albedo surfaces such as concrete and glass.

Vegetation also helps to modify and control climate. By acting as windbreaks, vegetation can effectively reduce wind velocity by fifty percent for ten to twenty times the height of a planting.[1] It can control the micro-climate by intercepting precipitation, by holding soil moisture, and by providing cooling shade in the summer.

Natural and introduced vegetation can increase the aesthetic value of the site in many ways including: its variety, color, form, texture, fragrance, contrast, etc.

During a general site analysis, vegetation may be categorized in broad terms such as types or associations. Specific site purposes, (such as an environmental education program would impose) eventually demand that a fairly complete vegetation inventory be compiled. An inventory which considers the ecological, economic, architectural, engineering, climate control and aesthetic values of vegetation can help in more effective development and utilization of the site. Developmental considerations might include, for example, leaving areas of a site in natural vegetative cover for ecological and functional reasons or introducing vegetation for any of the above named reasons.

[1] Lynch, Kevin. Site Planning.

SUMMARY OF VEGETATIONAL ANALYSIS:

Ecological Values - (see Ecology of the Site)

Economic Values - agricultural, forest, and other commercial resource uses; land values, functional considerations.

Architectural Values - defines exterior space, floors, walls, canopies, corridors, privacy control, screening, buffering, separation of incompatible activities and functions.

Engineering Values - acoustical control, atmospheric control, albedo control, soil erosion and water siltation control.

Climatic Value - interception of precipitation, windbreaks, frost depth control, soil-moisture retention, shade value, light intensity and quality control.

Aesthetic Values - visual quality, color, form, texture, fragrance, shade value and patterns, spatial proximity, contrast.

Physical Geology, Soils, Hydrology -

These areas are directly influenced by the historical geology of the region as described in regional and community influences. One important aspect of school site analysis is, therefore, to gather physical evidence which will help to relate the geological, hydrological, and soil characteristics of the site to this regional influence.

General considerations could include:

(examples relate to a glaciated region)

Physical Geology -

Land form and topographical features such as eskers, kames, moraines, glacial boulders, rocks, (stonewalls)
Glacial striations on rock outcroppings
Drift, pre-glacial and post-glacial features - fossils, emerged shorelines and beaches' silt and clay sedimentary deposits, rocks and minerals on site; weathering of rocks and minerals including those in man-made structures, and artifacts.

Soils -

Soil types, characteristics uses and limitations. This information is available through the Soil Conservation Service which has made extensive soil analyses and soil mappings.

In addition, rough field identification of soils can include the following six major classes:

clean sands and gravels
silty and clayey sands and gravels
inorganic clays, sandy, silty or gravelly clays
inorganic silts and fine clays
organic silts and clays
peat and muck

Hydrology -

On-site precipitation data: types, frequencies, quantities, duration, etc.

Surface water data: location, size, quality, formation of, age of; lakes, ponds, marshes, swales, estuaries, bays, major and minor drainage systems, run-off influences, erosion and deposition.

Ground water data: porosity, percolation rates, location, quantity, quality, aquifers, aquifer recharge areas, springs, wells, water table, indicators of water table.

The identification of geological, hydrological and soil characteristics have implications for site planning and development. For example, subsurface conditions may affect excavation, structural bearing strength and drainage. The height of the water table is important for supply and vegetation. A high water table, however, can cause difficulties such as in excavation work, flooded basements, insufficient structural bearing strength of the soil, and unstable foundations. High water tables are often indicated by water levels in wells and diggings, seepages and springs, as well as by indicator plants such as willows and poplars.

Landscape Character -

In addition to those factors already discussed, site analysis should also address itself to evaluation of the site from a visual or aesthetic viewpoint. Often the most successful site development is that which results in the least disruption of the character of the site. Analysis of the site's character should consider:

Visual Form -

Natural Spatial Organization: areas of enclosure and separation and linkage; land form, vegetation, light, shadow, color, texture, detail, continuity, sequence, structures, seasonal variations.

Scale: large (environmental)scale; small (human) scale.

Views and Viewpoints: focal points, dominant features, secondary features.

Materials: natural surficial materials (rock, earth, water, vegetation)

Sound and Noise -

intensity, quality, duration, loud areas, quiet areas.

Light -

orientation, albedo, intensity, quality, color, duration, shading.

Air and Air Circulation -

quality diversion by plants or structures, turbulence, eddys, general circulation patterns, cooling affects

Microclimate -

influences due to composite factors listed above.

Historic and Cultural Influences -

Recognition and documentation of the site's significant historic and cultural influences offers important evidence of man's cultural heritage. Such site information can serve as an indicator of factors and conditions which have been responsible in helping to influence the environment of the region as described under Regional and Community Influences.

Examples, such as old structures or other artifacts, can often be restored to original quality and can provide educational, historical, and recreational value. Furthermore, these help to add uniqueness and diversity to the man-made environment which, all too often, reflects standardization and sameness.

Existing Land Uses and Controls -

Analysis of existing land uses and controls is concerned with identifying these factors and determining how they affect the site as well as how they may be affected by subsequent development. Such factors include existing land use activities, structures, linkages and other physical man-made influences as well as management policies and controls which apply to the site. The term "affect" refers to physical conditions in the environment which result from such uses or controls and might include ecological, economic, technological, social, political, and aesthetic considerations.

Land uses considerations should include:

Identification of activity or use area and an appropriate physical description of same.

Location, capacity and user density of surface and subsurface service and utility functions such as roads, parking areas, power and pipe lines, communication lines, recreational facilities, disposal systems, etc.

Accessibility of activities from within and outside the site.

Relationship of activities or uses to the general circulation system.

Type and condition of existing structures.

Obvious and significant patterns of use

Policy and control considerations should include:

Zoned areas

Sub-division regulations

Safety and building codes

Rights of way

Easements

Other considerations

Also, the need for any of these based on the site analysis findings.

OFF-SITE CHARACTERISTICS AND INFLUENCES

The final area of consideration in site analysis concerns the examination of off-site characteristics which influence the site or which are or may be influenced by site development. Such considerations could include any of the previously discussed site analysis factors.

SUMMARY -

It can be seen that site analysis is concerned with all aspects of the site's surface and sub-surface physical conditions. These include both natural and man-made environmental influences relating to ecological, economic, political, social, technological, and aesthetic points of view. The outline which follows is a condensation of the previous information and provides a site analysis format which could be used by a committee working in the area of school site selection, planning, development and utilization. It could also be used by teachers and students in the environmental education emphasis within the school curriculum. This is especially important because the school site serves as an outdoor laboratory for activities in the environmental education program. It is important to recognize that site analysis, like community inventory, is performed at various levels of complexity and may, in fact, be a continuous process in view of the constant changes which occur within the natural and man-made environment.

GUIDELINES FOR SCHOOL SITE PLANNING

Outline for General Site Analysis

I. Aquisition of Adequate Base Maps, Aerial Photographs, or other Graphic Aids

II. Introductory Information

- A. Regional and Community Influences
  - 1. Geographic Location
  - 2. Size
  - 3. General Information
    - a. Natural Influences
    - b. Historic and Cultural Influences
    - c. Economic and Social Influences
    - d. Institutional and Recreational Influences

III. On-Site Characteristics and Influences

- A. Topography and Drainage
- B. Ecology of the Site
- C. Vegetation
- D. Physical Geology, Soils, and Hydrology
- E. Landscape Character
- F. Historic and Cultural Influences
- G. Existing Land Uses and Controls

IV. Off-Site Characteristics and Influences

(same as III)

RESOURCE INFORMATION FOR SITE ANALYSIS

General Information on Site Planning

1. Lynch, Kevin, Site Planning. The M.I.T. Press, Massachusetts Institute of Technology, Cambridge, Mass., 1962.

2. McHarg, Ian L., Design with Nature. Published for the American Museum of Natural History. The Natural History Press, Garden City, New York, 1969.

Specific Information

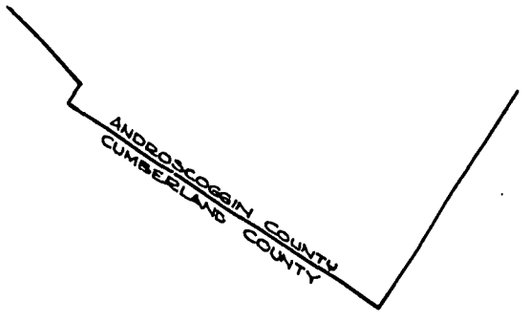
1. Threshold to Maine, Resource Conservation and Development Plan, Prepared under authority of the Food and Agriculture Act of 1962, U.S. Congress (Public Law 87-703), June, 1970.

2. Also see list of specific references in Guidelines for Planning and Implementing a Comprehensive Community Inventory. Maine Environmental Education Project, Title III, ESEA, Yarmouth, Maine, 1971.

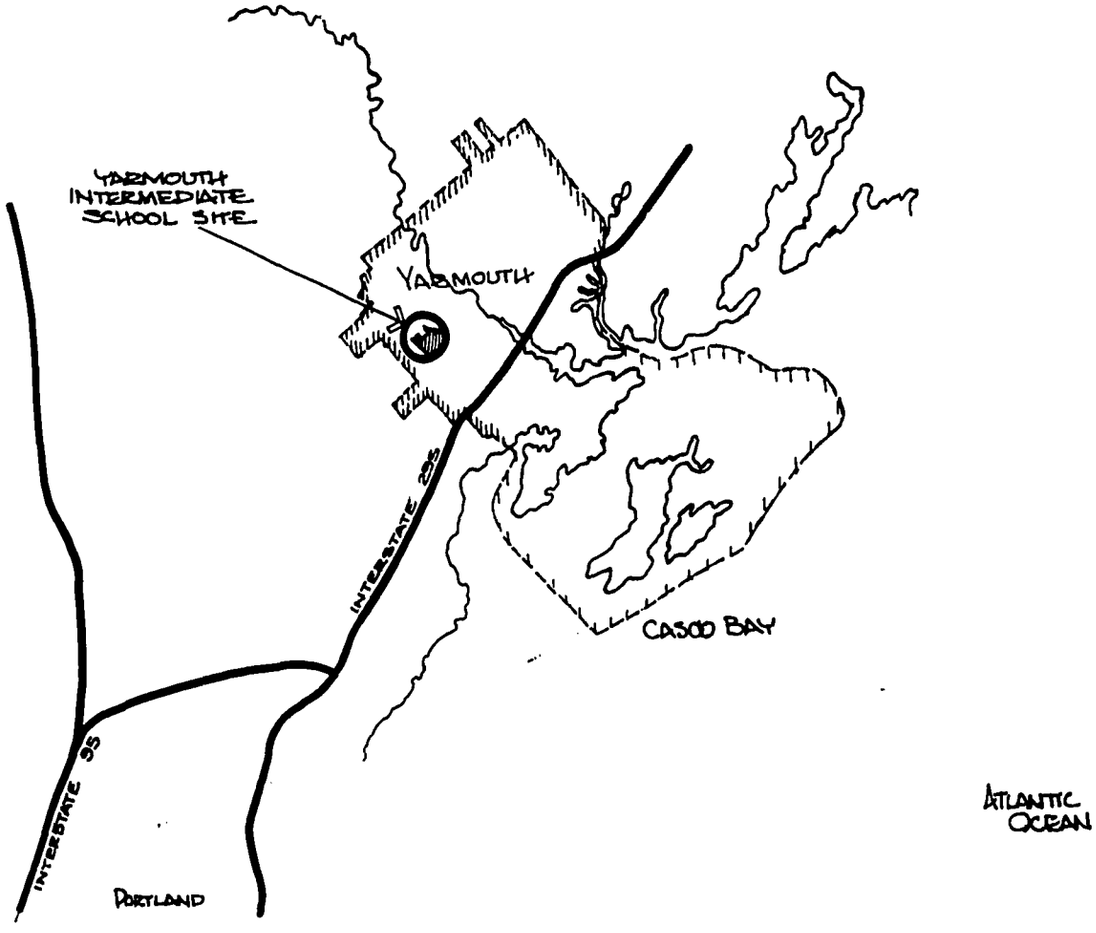
EXAMPLES

OF

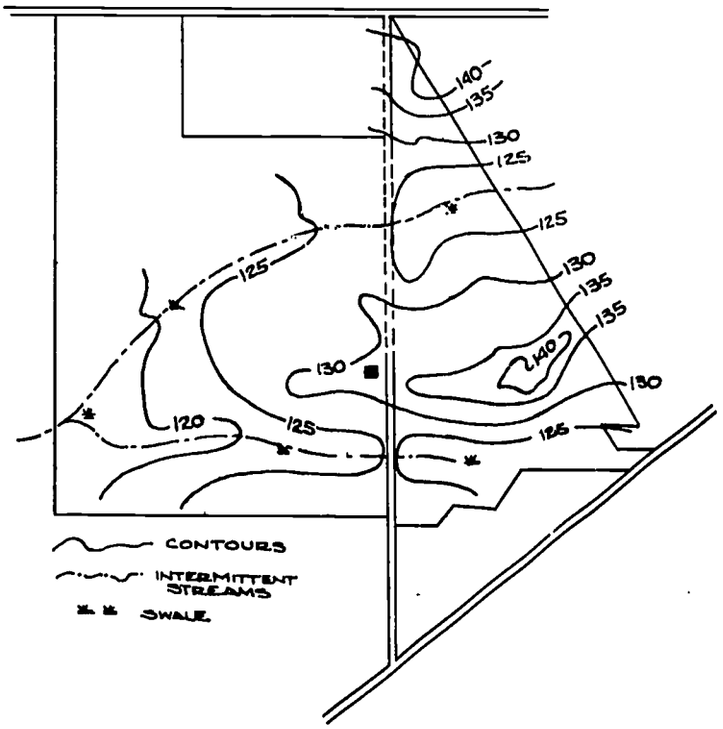
SITE ANALYSIS



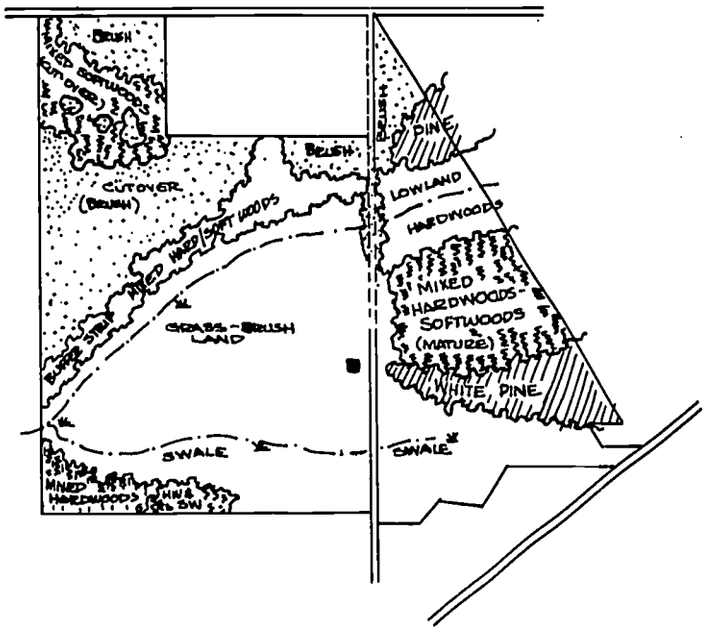
REGIONAL AND COMMUNITY SETTING



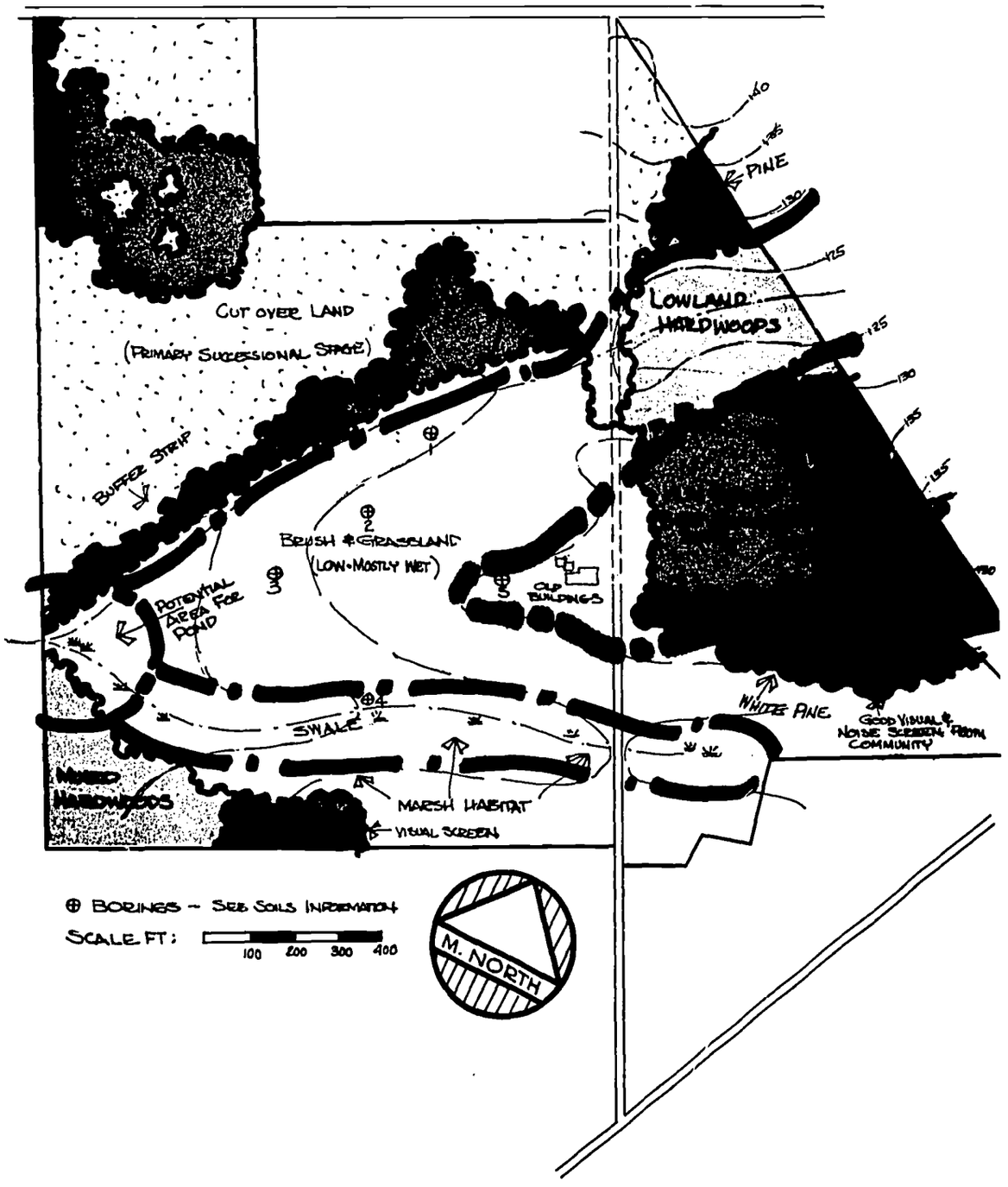
TOPOGRAPHY - DRAINAGE



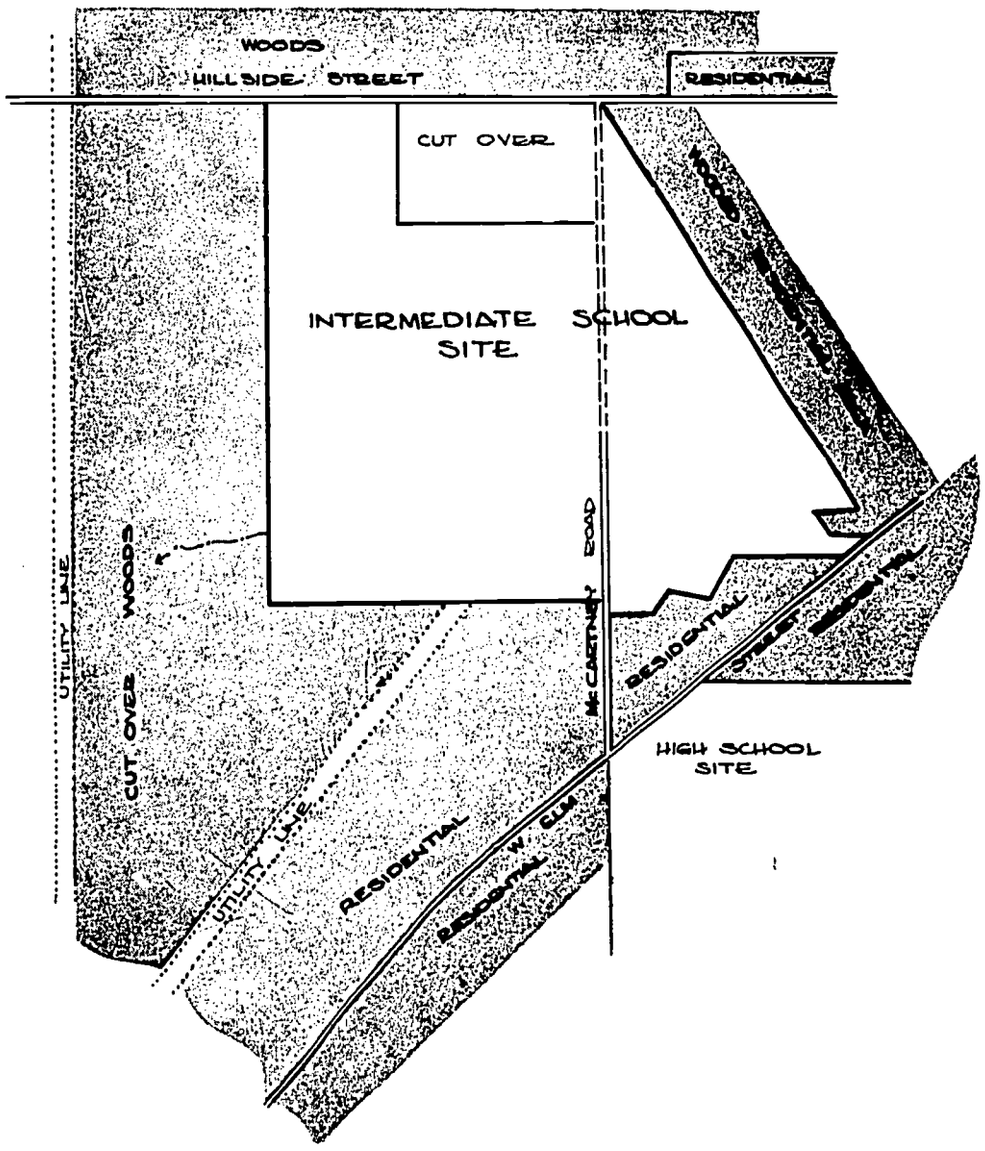
VEGETATION



SITE ANALYSIS



OFF-SITE CHARACTERISTICS



SITE PLANNING

PHASE II: Program Development

GUIDELINES FOR SCHOOL SITE ANALYSIS: PHASE II

Program Development

Once the need for a particular kind of development or purpose has been recognized, and broad objectives have been established, program development can be undertaken. Just as site analysis is concerned with making an in-depth study of the character of the site, program development is concerned with analyzing the nature of the particular purpose or use for that site. Developing a program to fit the site helps to create the greatest degree of compatibility between site and purpose. Compatability is reflected by functional design which results in the least destructive disturbance to the site.

The end result of program development is the "program," which, when combined with site analysis, helps to answer three basic questions:

What components need to be created (or modified) on the site?

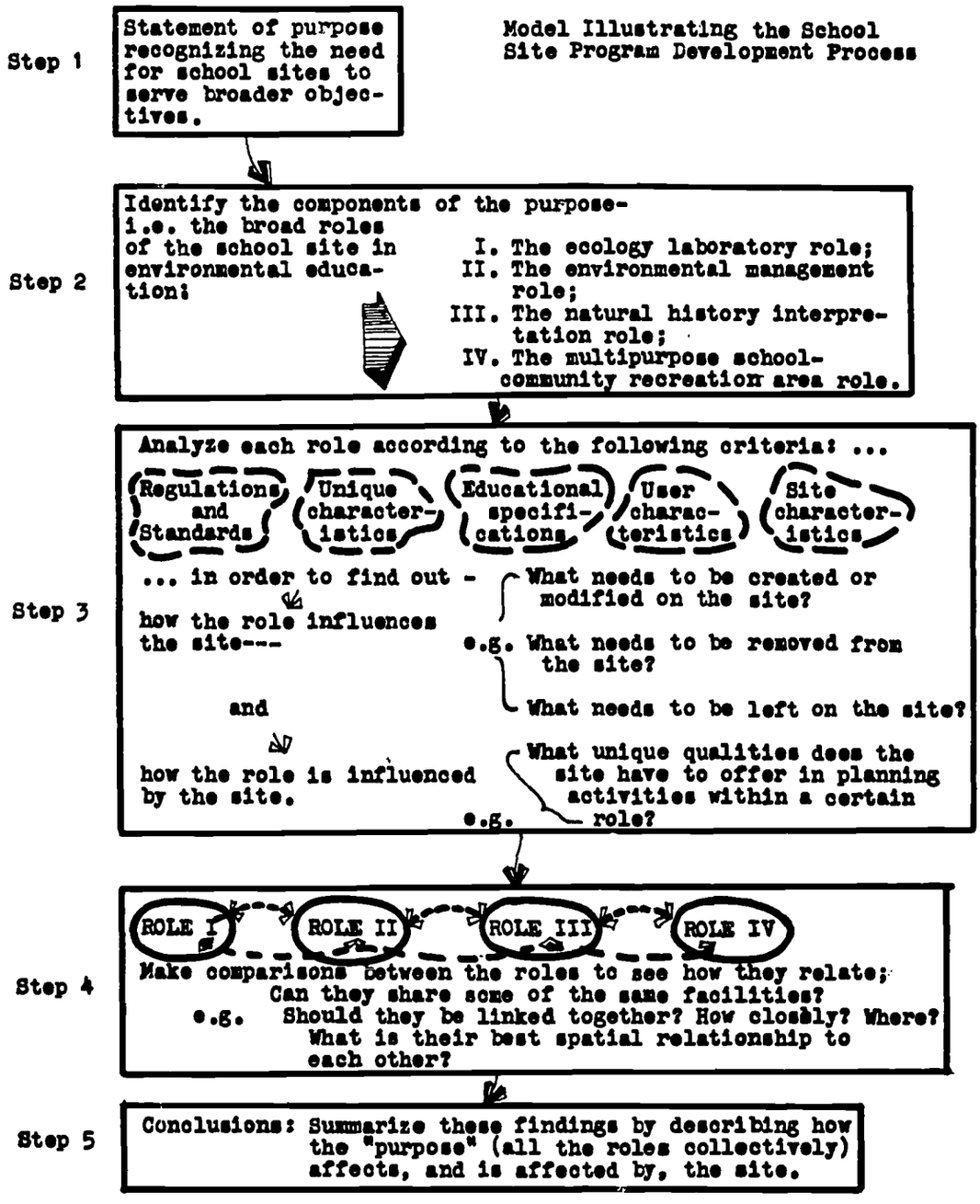
What components need to be left on the site?

What components need to be removed from the site?

The answers to these questions are expressed graphically in the third phase of site planning, Design Concept Development, where the site and program are "fitted" together into a compatible working relationship.

The following outline and examples illustrate, in part, the process of program development.

Model Illustrating the School Site Program Development Process



Steps 1 + 2 + 3 + 4 + 5 = THE PROGRAM

Based on the previous model, the program might begin as follows:

Step 1: Statement of purpose and objectives

School sites can and should be planned and developed to provide greater benefits to the school and community. In addition to providing space for the physical plant, school sites should be selected, designed, and utilized in a manner which will:

1. include broader instructional programs relevant to present and future social and environmental problems and needs;
2. encourage greater community use of a community-owned resource;
3. provide more efficient and economic operation and maintenance of the physical plant through better control and management of environmental factors, such as modification of the microclimate through plantings or orienting activities to take best advantage of microclimatic conditions;
4. serve to exemplify and promote a land ethic to all citizens of the community.

Step 2: The roles of the school site in environmental education

The various roles of the school site in the environmental education program can help to achieve the above objectives. These roles include serving as:

1. an ecology laboratory;
2. an environmental management laboratory;
3. a natural history interpretive area;
4. a multipurpose school-community recreation area.

Step 3: Analysis of these roles for program development

Five research areas are suggested to serve as criteria for analyzing each role. The information which results from this analysis should lead to specific site design considerations and implications. These in turn affect what will be created or modified on site, removed from the site, and left on the site.

The following are examples of some of the kinds of information to seek and some general design considerations and implications which could arise from that information.

Analysis criteria	Information sought	Design considerations/ implications
1. Regulations and Standards	Zoning ordinances Safety and health Engineering specs. Construction specs.	Location of boundary and lot lines, buildings, activities, circulation routes, route densities, protection of site during construction, linkage of activities, etc.

2.	Unique Characteristics	Specific information about the role, e.g. what makes the ecology role different from the natural history interpretive role.	Helps to identify and protect special areas and components on site needed for that role, e.g. diversity of habitats; diversity of plants and animals; diversity of successional stages.
3.	Educational Specifications	Identifies educational level of user; states specific role objectives; determines content to be taught; determines the activities which will take place on-off site in that role.	Establishes specific needs and limits of the areas and components to be used for those activities. (Specific site characteristics also help determine the content and activities.)
4.	User Characteristics	Physical, psychological, social needs of user.	Suggests considerations such as - best location of activities, user safety and protection, circulation densities, best pathway gradients for comfort, need for variety of activities.
5.	Site Characteristics	Information derived from site analysis: a. general regional and community influence b. on-site characteristics c. adjacent off-site characteristics.	Shared school-community facilities and land uses; design compatible with region and community; soil suitability and capability; circulation routes and linkages; aesthetic views; points of interest; microclimatic conditions.

Steps 4 and 5: (Self explanatory -- see Model)

SITE PLANNING

PHASE III: Design Concept Development

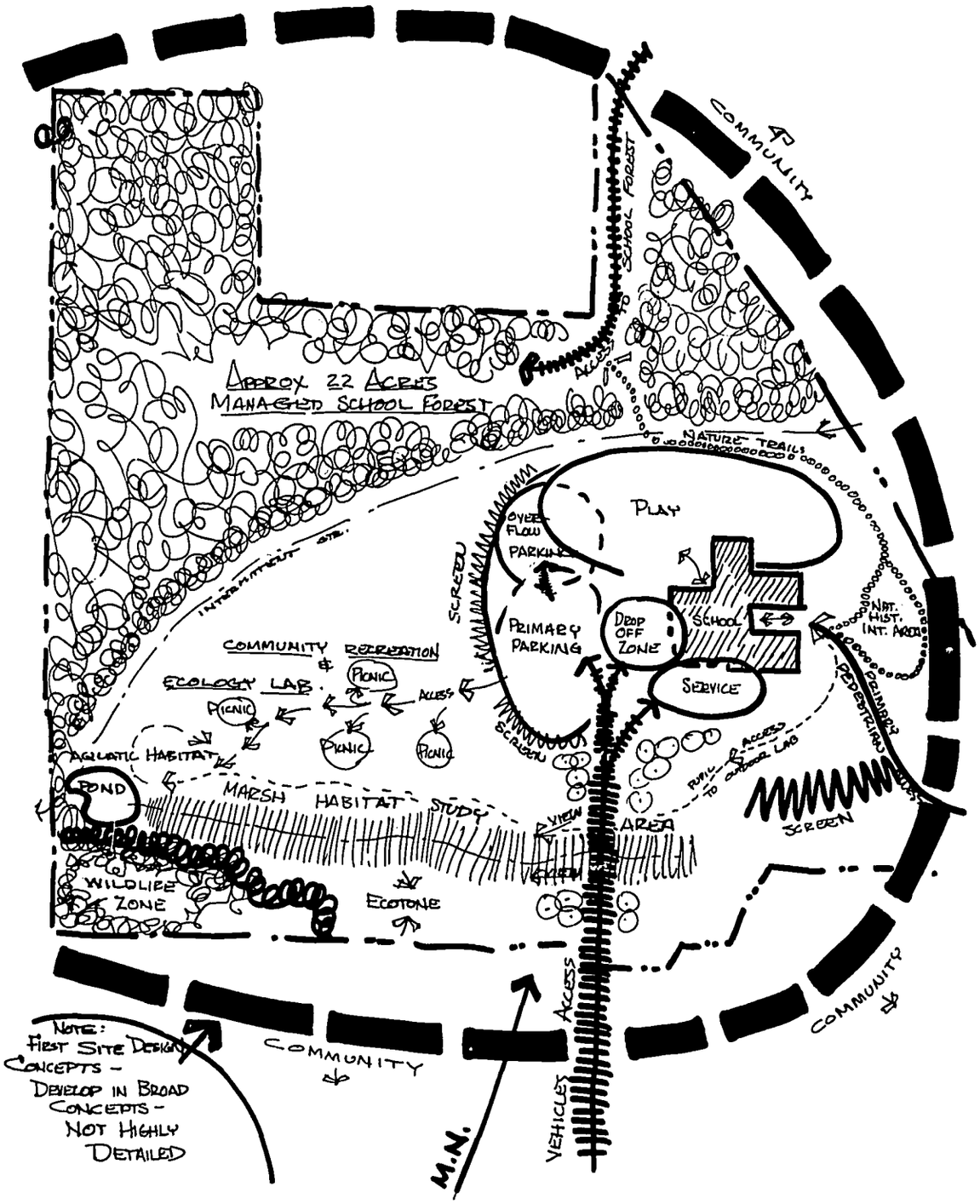
GUIDELINES FOR SCHOOL SITE ANALYSIS: PHASE III

Design Concept Development

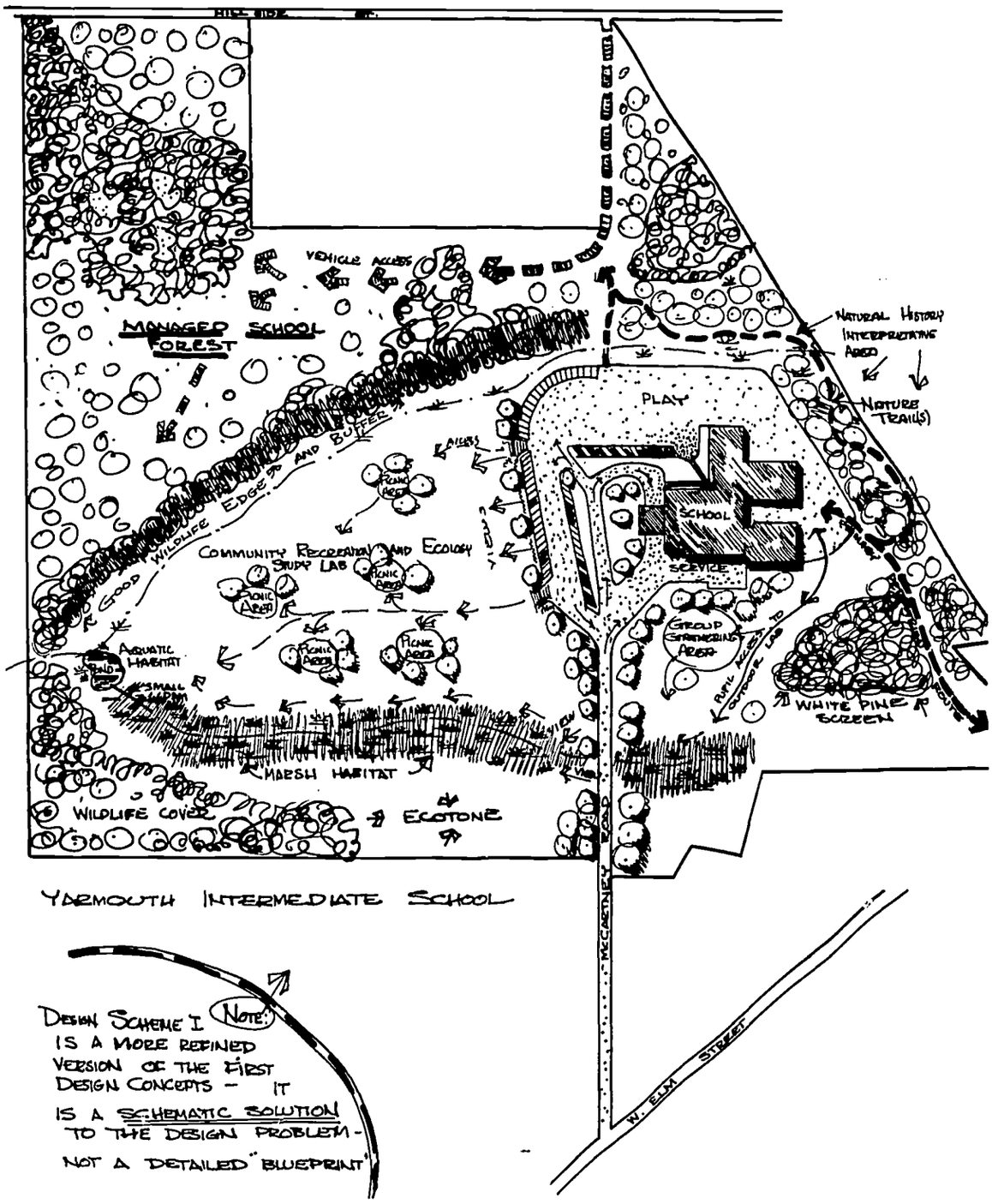
The final phase, Design Concept Development, is the graphic interpretation of how the site and program should be blended into a compatable solution.

The following examples illustrate the Design Concept Development phase for the Yarmouth Intermediate School Site. Although the Program Development phase for this site is not included in the manual, it follows the same pattern of structure and analysis which has previously been presented.

BROAD DESIGN CONCEPT DEVELOPMENT



DESIGN SCHEME I



YARMOUTH INTERMEDIATE SCHOOL

NOTE:
DESIGN SCHEME I IS A MORE REFINED VERSION OF THE FIRST DESIGN CONCEPTS - IT IS A SCHEMATIC SOLUTION TO THE DESIGN PROBLEM - NOT A DETAILED "BLUEPRINT"